

EMCal-RICH level1 trigger performance at PHENIX

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for the PHENIX collaboration

EMCal-RICH trigger

Trigger for
high pT γ s
 h^\pm s
electrons

Physics

- ΔG from A_{LL} (of direct γ , $\pi^0 \rightarrow 2\gamma, h^\pm$)
- $\Delta q/q$ with W production asymmetry ($W \rightarrow e\nu$)
- ΔG from charm production asymmetry ($\text{charm} \rightarrow e\nu X$)
- pQCD test through A_N ($\pi^0 \rightarrow 2\gamma, h^\pm$)
- Comparison data for Heavy Ion collision ($\pi^0 \rightarrow 2\gamma, h^\pm$, $J/\psi \rightarrow ee$)

pp run in run2
(^{'01}Dec~^{'02}Jan)

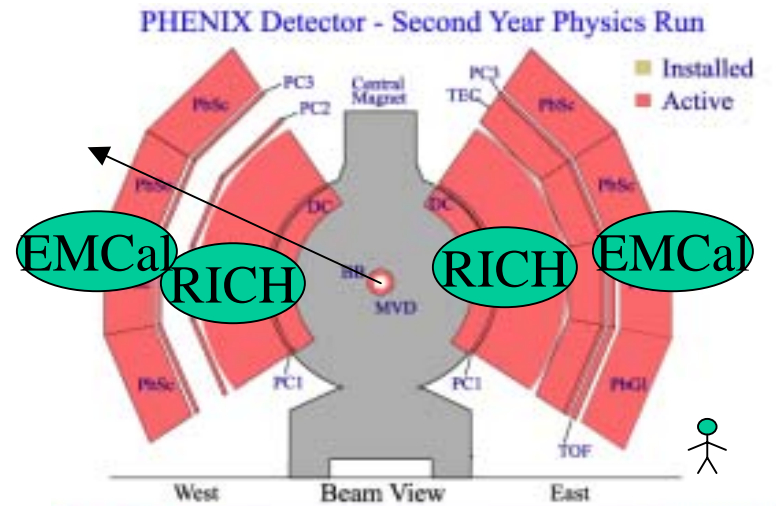
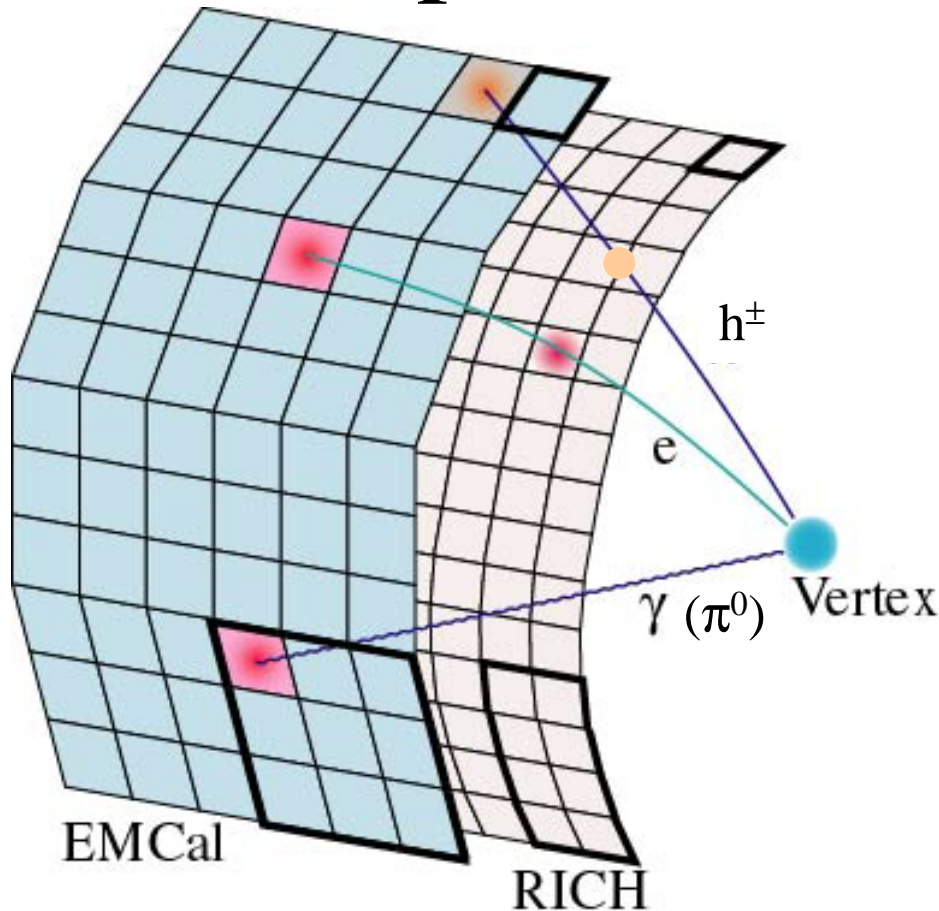
Rejection power requirement in run2

averaged trigger rate : $\sim 20\text{kHz}$ (max 75kHz)

DAQ bandwidth : $\sim 1\text{kHz}$ (200Hz assigned to this trigger)

—————→ factor 100 was needed

Concept of EMCal-RICH trigger



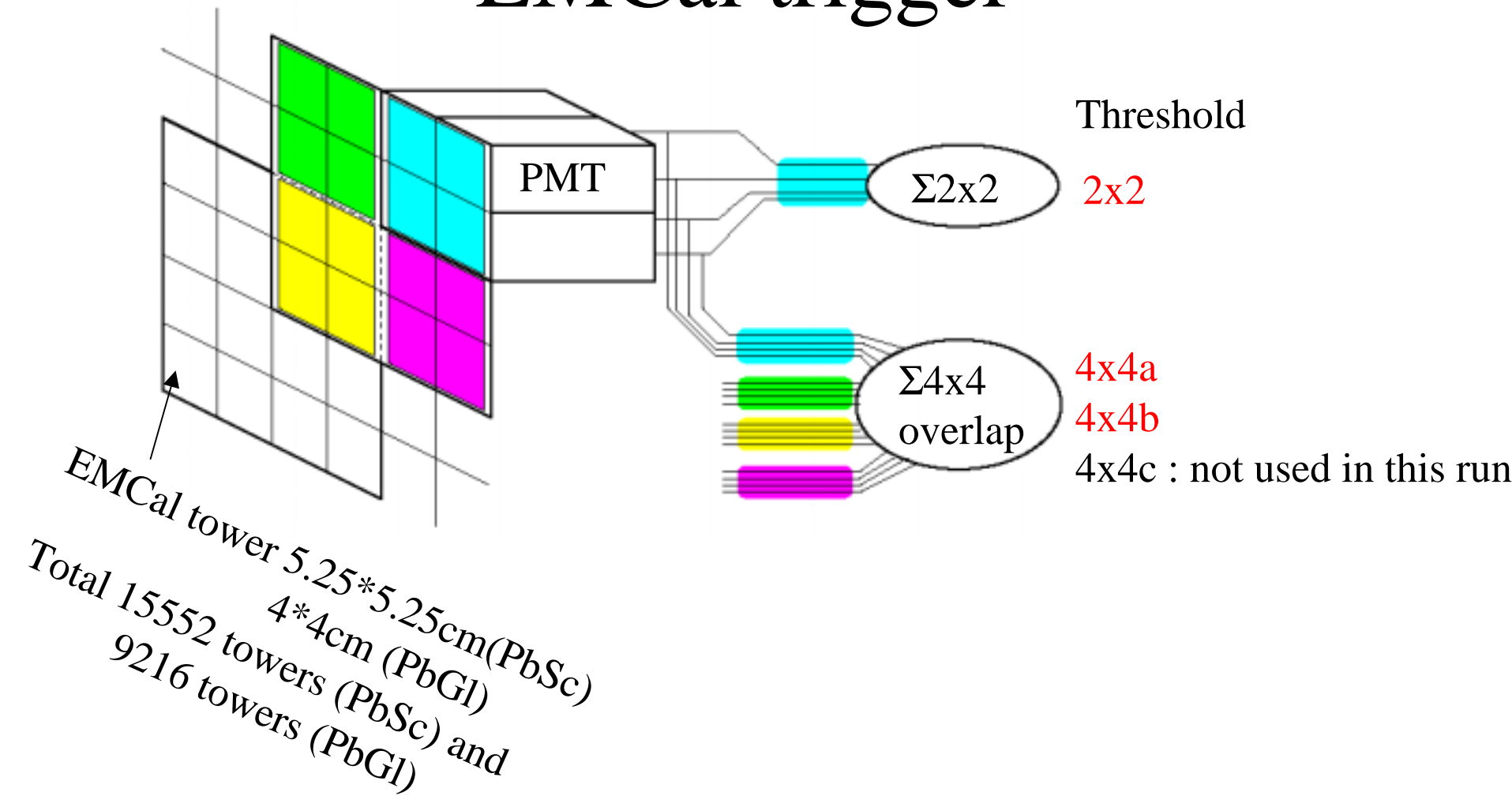
PHENIX central arm
2 types of EMCal (PbSc, PbGl)

$\gamma(\pi^0)$: EMCal

Electron : EMCal and RICH

h^\pm : EMCal and RICH (through hadronic interactions)

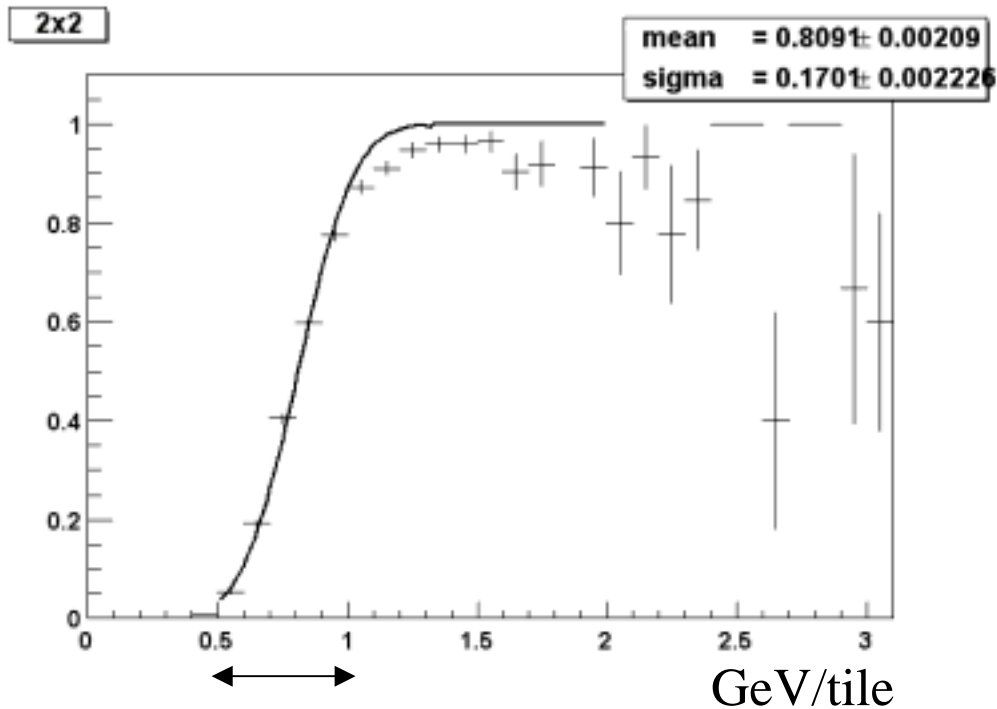
EMCal trigger



Trigger Performance Check

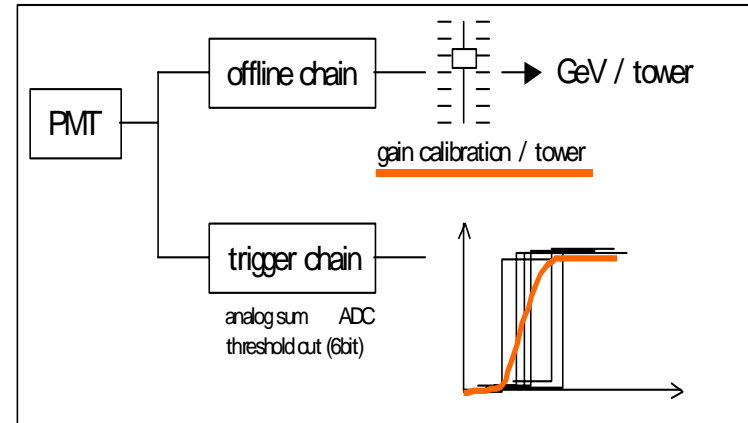
- ◆ Turn on curve
(important for the rejection power)
- ◆ Live ratio

Trigger Turn On Curve

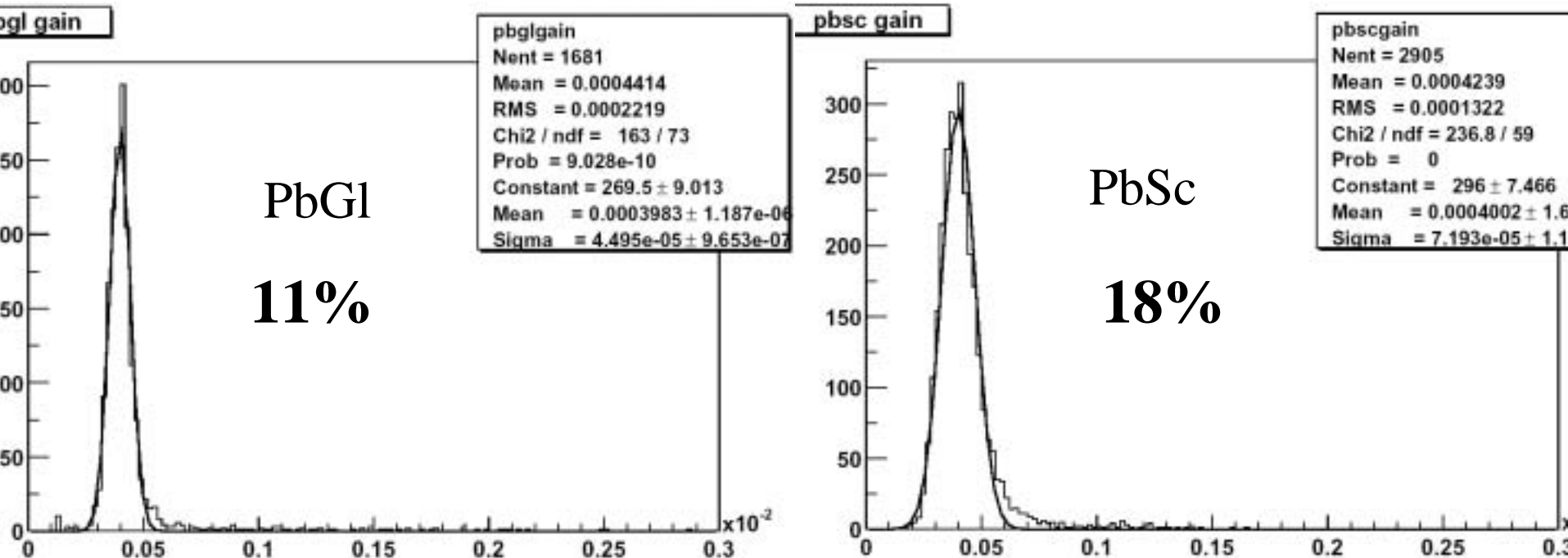


Turn on width comes from 2 places.

- ◆ PMT gain variation
- ◆ Trigger circuit



EMCal PMT gain variance



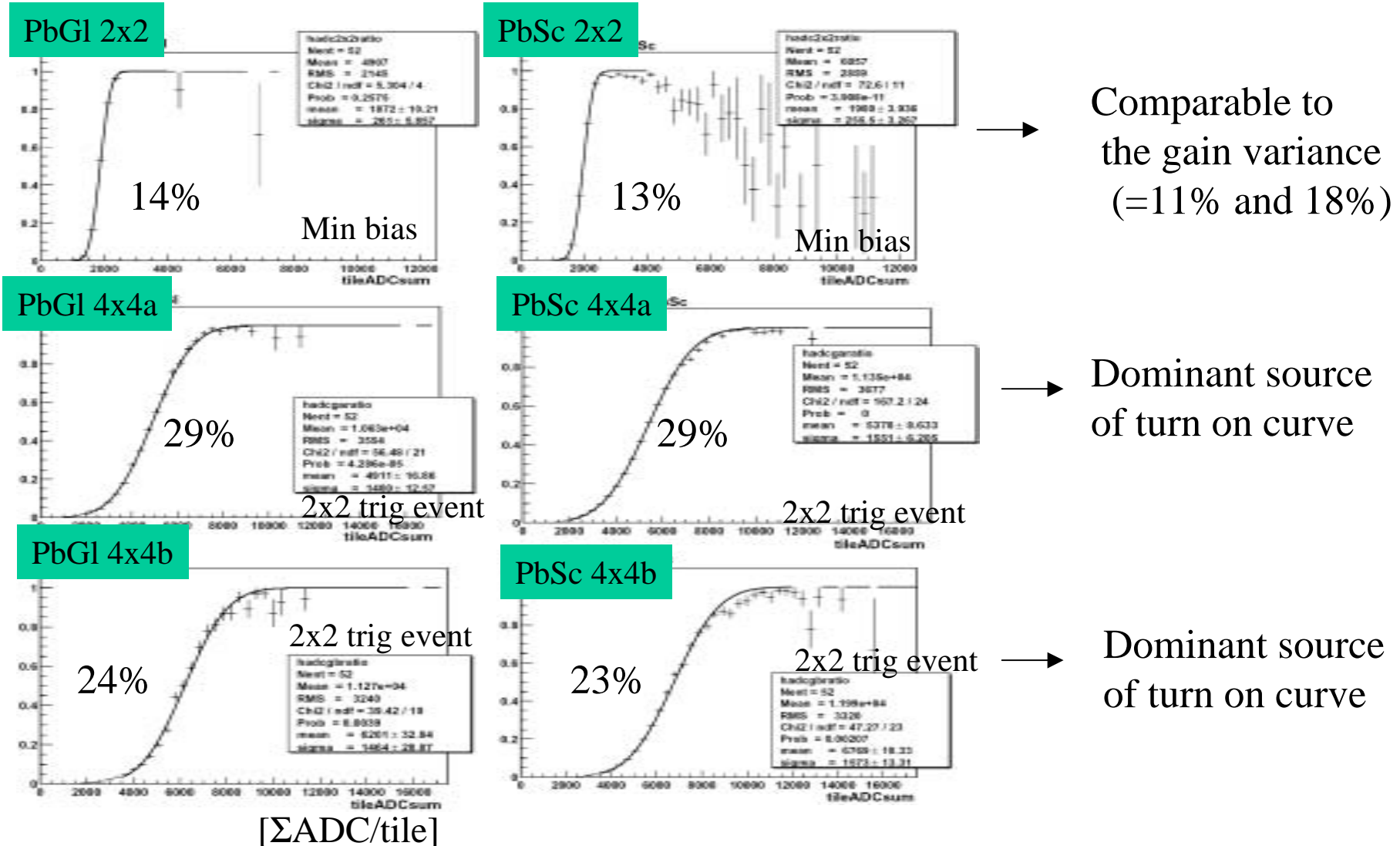
PbGl has better shape than PbSc.

Both of them have some very off gain PMT.

(Some of them were not used in the last plots as a offline mask)

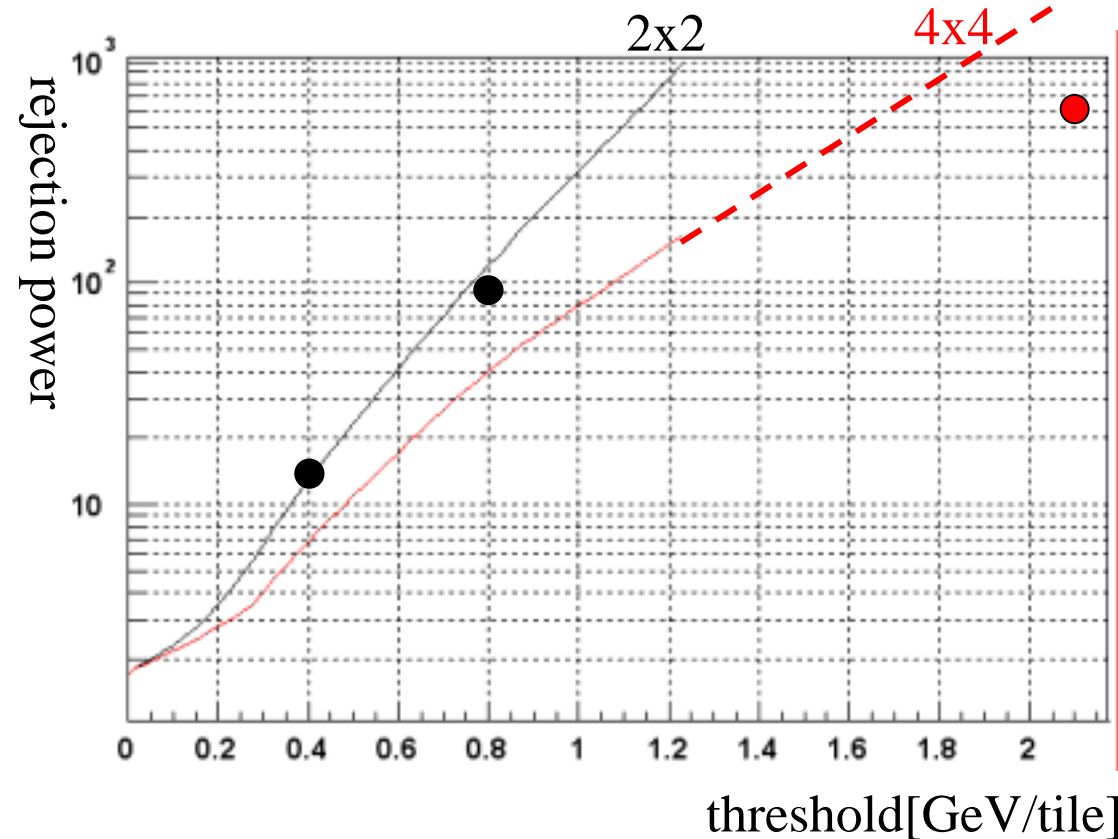
Trigger turn on curve for ADC value

To reject gain variance effect. Only circuit “noise” appears.



Rejection Power of EMCal Trigger

compared to the MC simulation with sharp turn on.

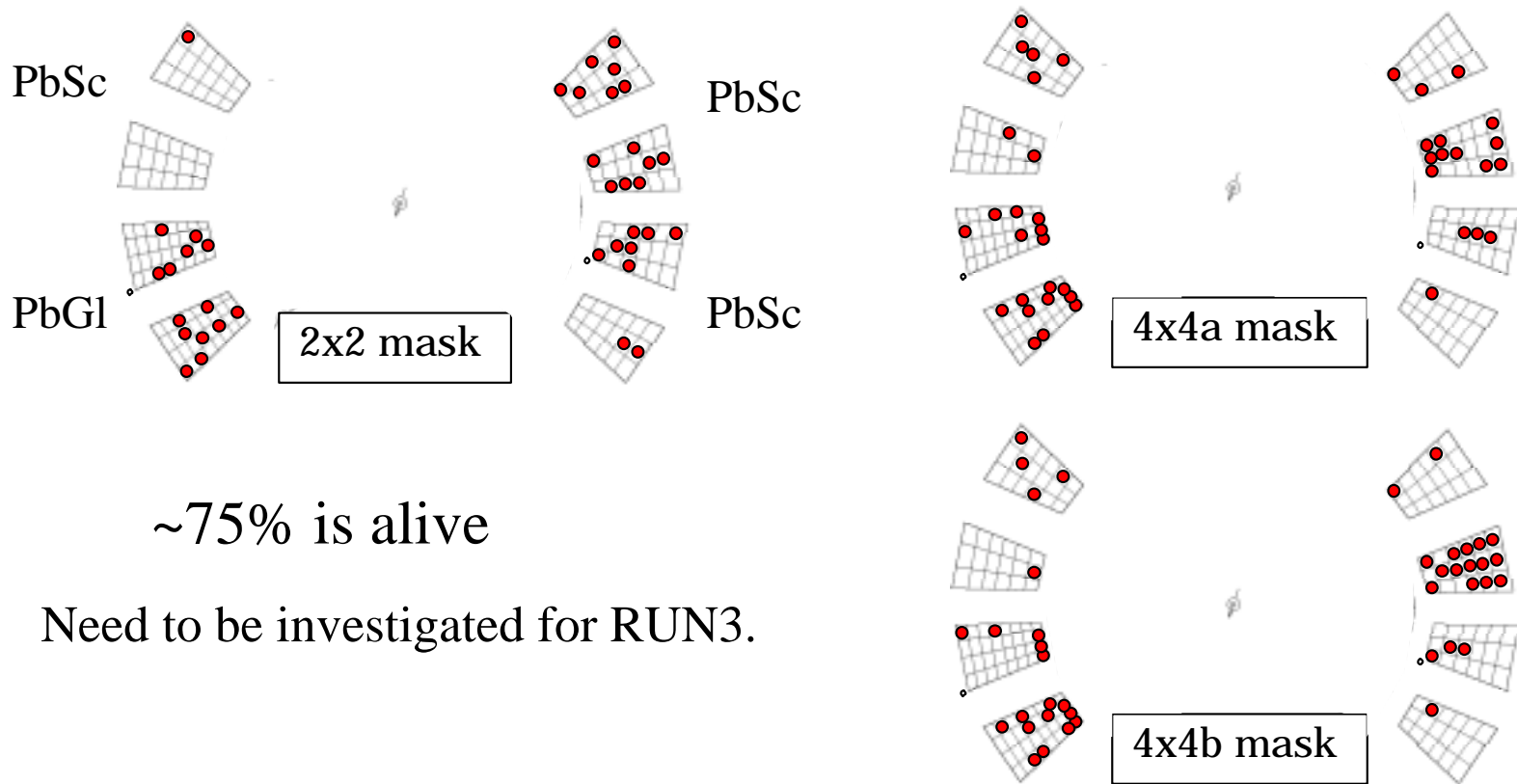


4x4 has low rejection power than expectation because of wide turn on curve.

Live Ratio

Dead area mainly came from hot channel mask

Unit= super module (SM)

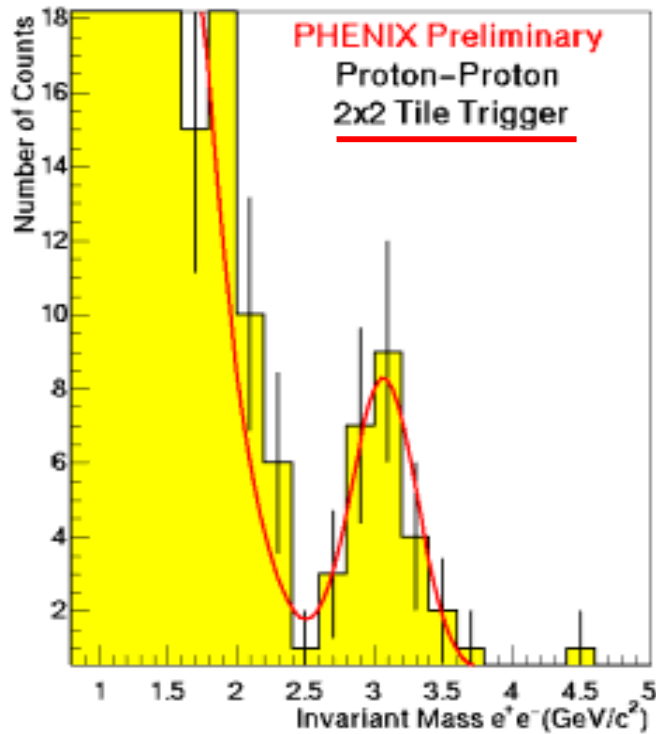


Need to be investigated for RUN3.

Profits in Various Channels

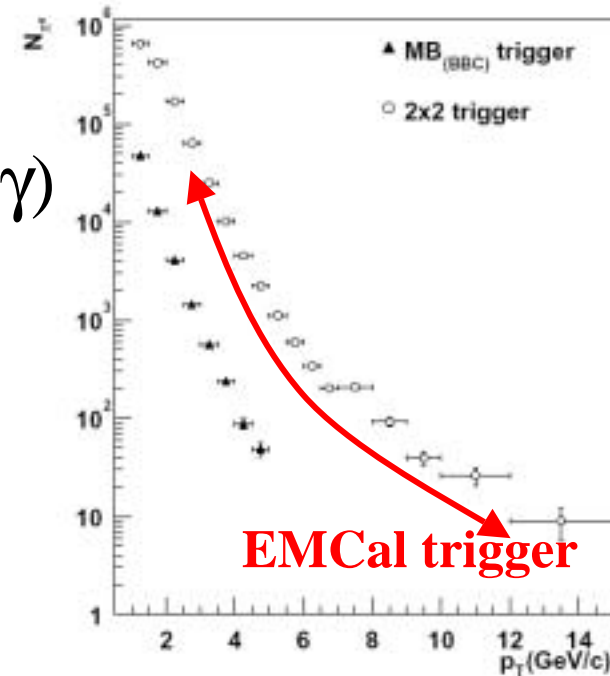
from EMCal 2x2 trigger
 $\sim 40\text{nb}^{-1}$

J/ψ (e)

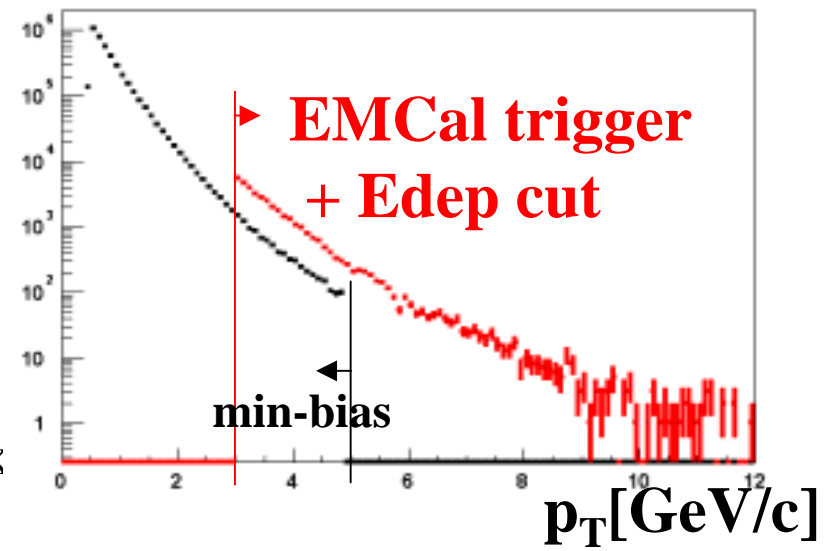


- Mass(ee)

π^0 (γ)



h^\pm

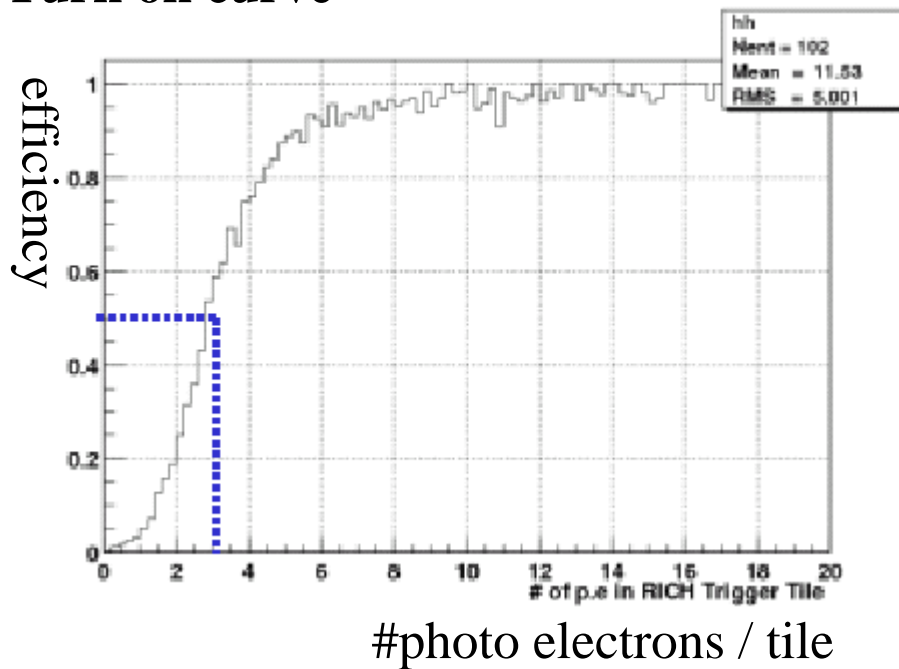


RICH trigger

Structure

4x5 PMT is the unit.
total 256 tiles.

Turn on curve



Live ratio

38tiles (14.8%) in run2
Bad parts are already fixed for RUN3

Summary

EMCal-RICH trigger was newly installed at PHENIX RUN2.

EMCal trigger

~75% worked properly

Turn on curve width came from PMT gain variance and trigger circuit.

Statistical gain of π^0 , h^\pm , J/ψ

RICH trigger

~15% of RICH trigger units worked properly.

For the next run (RUN3 January,2003) :

Luminosity : ~20× RUN2

DAQ ability : ~5×

We will be in severer condition.

- ◆ raise the live ratio
- ◆ EMCal-RICH coincidence
- ◆ reduce the turn on width